



HORMONES

It is a chemical substance which is produced in one part of the body, enters the circulation and is carried to distant target organs and tissues to modify their structures and functions.

The word hormone is derived from a Greek word "Hormacin" which means to "Excite". Hormones are strictly speaking stimulating substances and act as body catalysts. The hormones catalyse and control diverse metabolic processes, despite their varying actions and different specificities depending on the target organ.

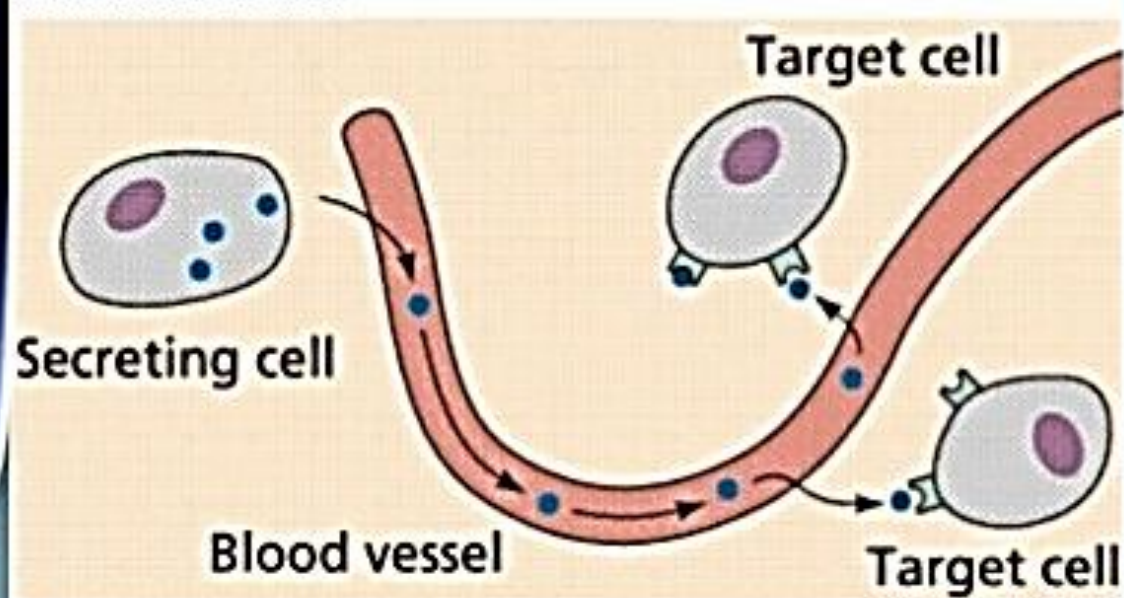
HORMONE SECRETION

Hormones in animals are often transported in the blood. Endocrine hormone molecules are secreted (released) directly into the bloodstream, while exocrine hormones (ecto-hormones) are secreted directly into a duct, and from the duct they either flow into the bloodstream or they flow from cell to cell by diffusion.

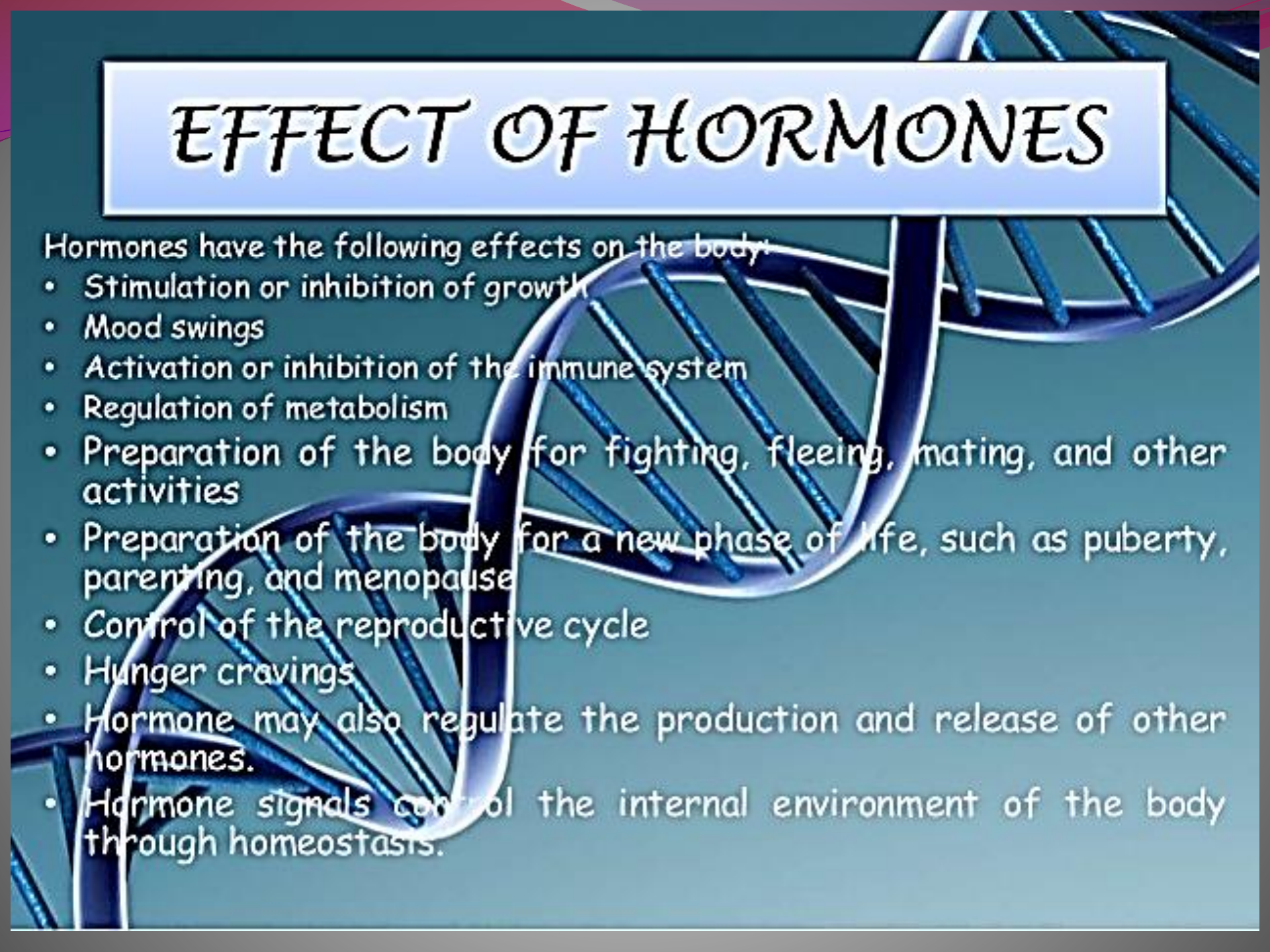
Hormone secretion can be stimulated and inhibited by:

- Other hormones (stimulating or releasing hormones)
- Plasma concentrations of ions or nutrients
- Neurons and mental activity
- Environmental changes, Eg. Change in light or temperature.

Hormone secretion



EFFECT OF HORMONES



Hormones have the following effects on the body:

- Stimulation or inhibition of growth
- Mood swings
- Activation or inhibition of the immune system
- Regulation of metabolism
- Preparation of the body for fighting, fleeing, mating, and other activities
- Preparation of the body for a new phase of life, such as puberty, parenting, and menopause
- Control of the reproductive cycle
- Hunger cravings
- Hormone may also regulate the production and release of other hormones.
- Hormone signals control the internal environment of the body through homeostasis.

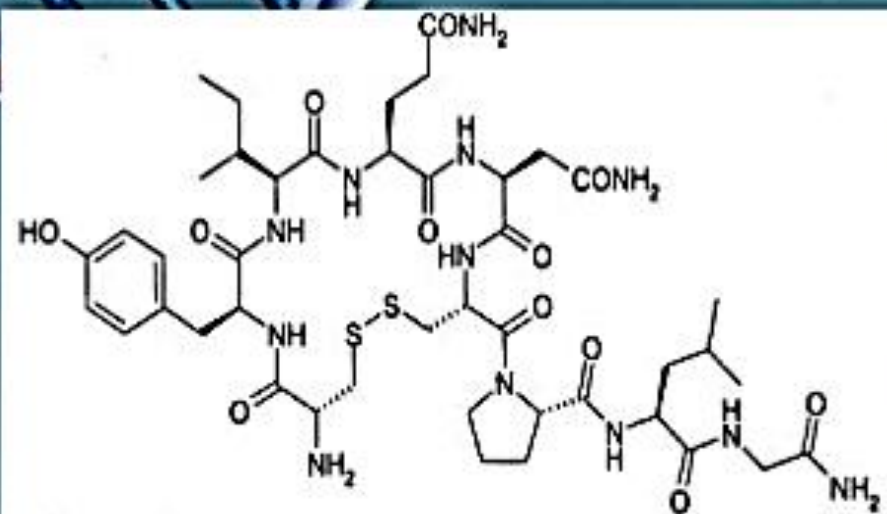
CLASSIFICATION OF HORMONES

Most commonly, hormones are categorized into four structural groups, with members of each group having many properties in common:

- Peptides and proteins
- Amino acid derivatives
- Steroids

1. PEPTIDES AND PROTEINS:

Peptide and protein hormones are products of translation. They vary considerably in size and post-translational modifications, ranging from peptides as short as three amino acids to large, multi-subunit glycoproteins. Peptide hormones are synthesized in endoplasmic reticulum, transferred to the Golgi and packaged into secretory vesicles for export. E.g. Oxytocin.



Oxytocin – cyclo^{1,6}-Cys-Tyr-Ile-Gln-Asn-Cys-Pro-Leu-Gly-NH₂

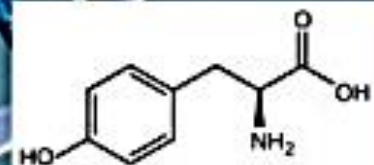
2. AMINO ACID DERIVATIVES:

There are two groups of hormones derived from the amino acid, tyrosine:

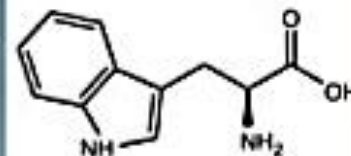
- Thyroid hormones are basically a "double" tyrosine with the critical incorporation of 3 or 4 iodine atoms.
- Catecholamine include epinephrine and norepinephrine, which are used as both hormones and neurotransmitters.

Two other amino acids are used for synthesis of hormones:

- Tryptophan is the precursor to serotonin and the pineal hormone melatonin.
- Glutamic acid is converted to histamine.



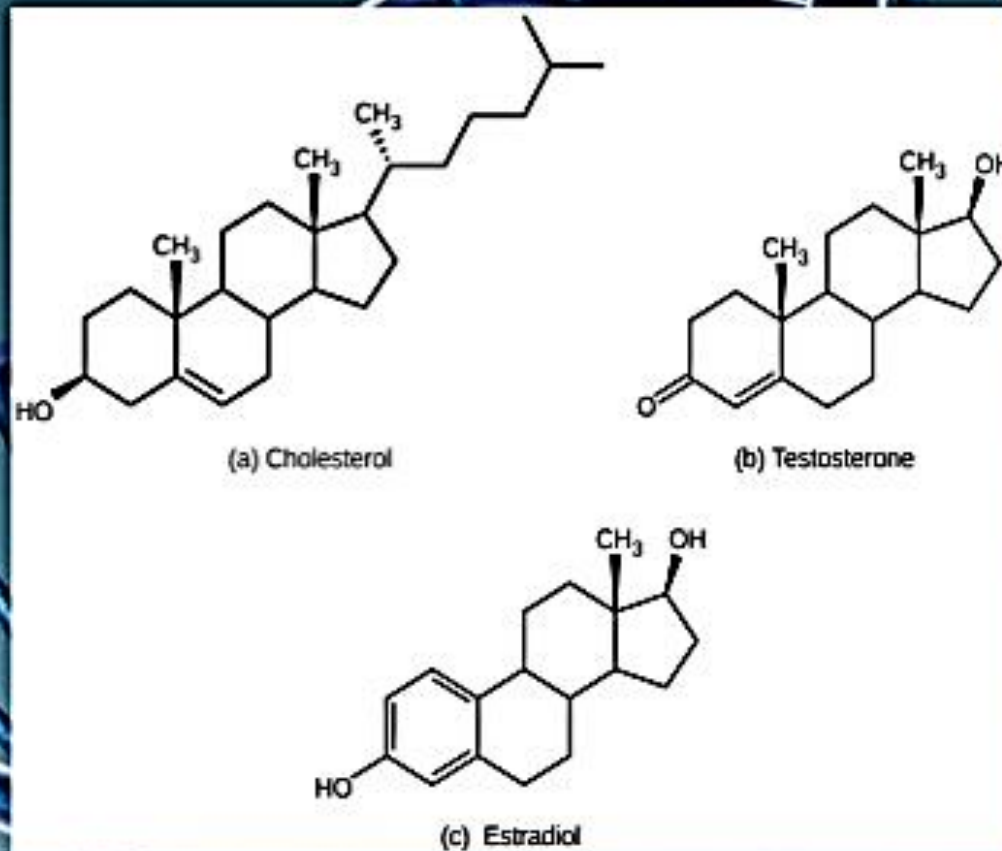
Tyrosine



Tryptophan

3. STEROIDS:

Steroids are lipids and, more specifically, derivatives of cholesterol. Examples include the sex steroids such as testosterone and adrenal steroids such as cortisol.



ACTION OF MECHANISIM

Understanding mechanism of action is not only of great interest to basic science, but critical to understanding and treating diseases of the endocrine system and in using hormones as drugs.

There are two fundamental mechanisms by which a hormone can change its target cell. These mechanisms are:

1. ACTIVATION OF ENZYMES AND OTHER DYNAMIC MOLECULES:

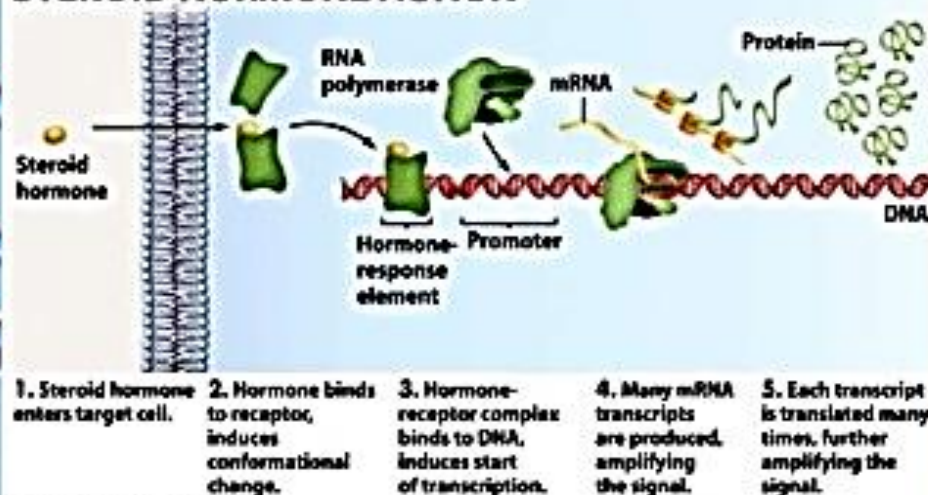
Most enzymes fluctuate between conformational states that are catalytically active versus inactive. Many hormones affect their target cells by inducing such transitions, usually causing an activation of one of more enzymes. Because enzymes are catalysts and often serve to activate additional enzymes, a seemingly small change induced by hormone receptor binding can lead to widespread consequences within the cell.

2. MODULATION OF GENE EXPRESSION:

Stimulating transcription of a group of genes clearly can alter a cell's phenotype by leading to a burst of synthesis of new proteins. Similarly, if transcription of a group of previously active genes is shut off, the corresponding proteins will soon disappear from the cell.

More specifically, when a receptor becomes bound to a hormone, it undergoes a conformational change which allows it to interact productively with other components of the cells, leading ultimately to an alteration in the physiologic state of the cell.

STEROID HORMONE ACTION



HORMONE RECEPTORS

Despite the molecular diversity of hormones, all hormone receptors can be categorized into one of two types, based on their location within the cell:

LOCATION OF RECEPTOR	CLASSES OF HORMONES	PRINCIPLE MECHANISM OF ACTION
Cell surface receptors (plasma membrane)	Proteins peptides, catecholamine and eicosanoids (water soluble)	Generation of second messengers which alter the activity of other molecules, usually Enzymes, within the cell.
Intracellular receptors (cytoplasm and/or nucleus)	Steroids and thyroids hormones (lipid soluble)	Alter transcriptional activity of responsive Genes.

THE FINAL EFFECTS OF HORMONES ACTION

1. Change the permeability of cell membrane.
2. Accelerate the penetration of substrates, enzymes, coenzymes into the cell and out of cell.
3. Acting on the allosteric centers, affect the activity of enzymes (Hormones penetrating membranes).
4. Affect the activity of enzymes through the messengers (cAMP). (Hormones that can not penetrate the membrane).
5. Act on the genetic apparatus of the cell (nucleus, DNA) and promote the synthesis of enzymes (Steroid and thyroid hormones).

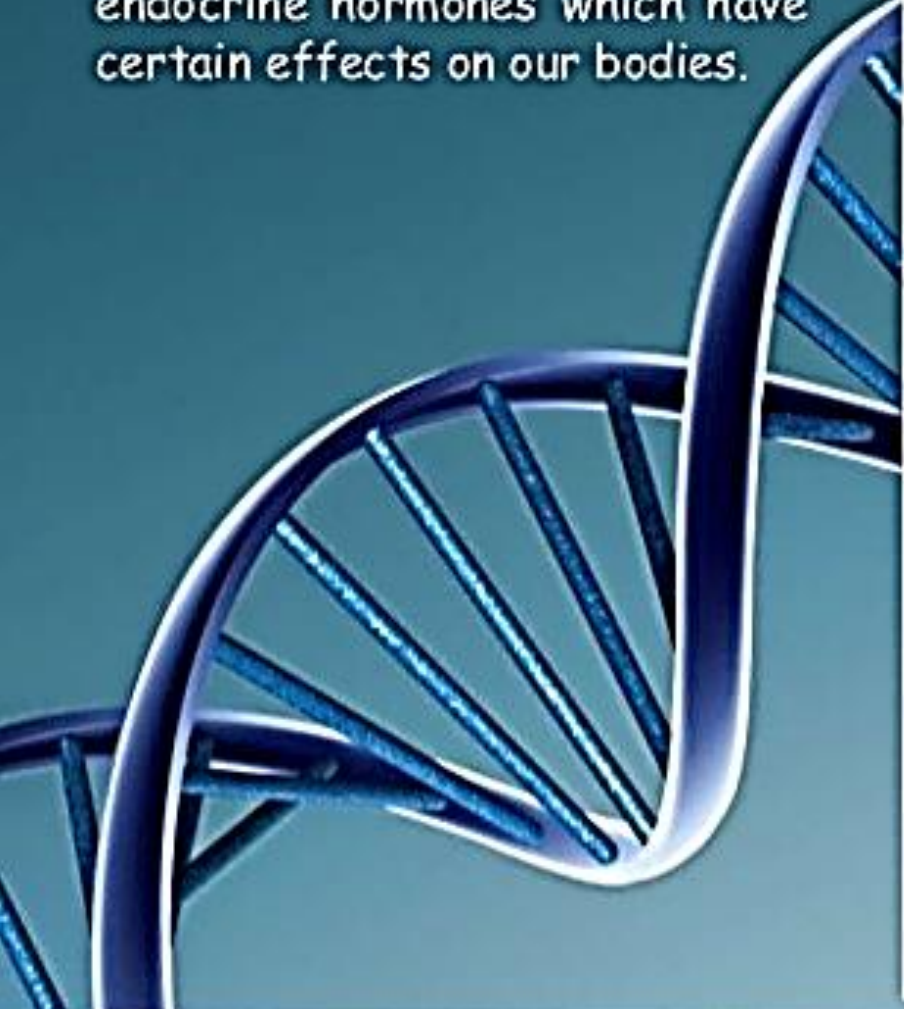
FACTORS REGULATING HORMONE ACTION

Action of a hormone at a target organ is regulated by four factors:

1. Rate of synthesis and secretion: The hormone is stored in the endocrine glands.
2. In some cases, specific transport systems in plasma.
3. Hormone-specific receptors in target cell membranes which differ from tissue to tissue.
4. Ultimate degradation of the hormones usually by the liver or kidneys.

ENDOCRINE HORMONES

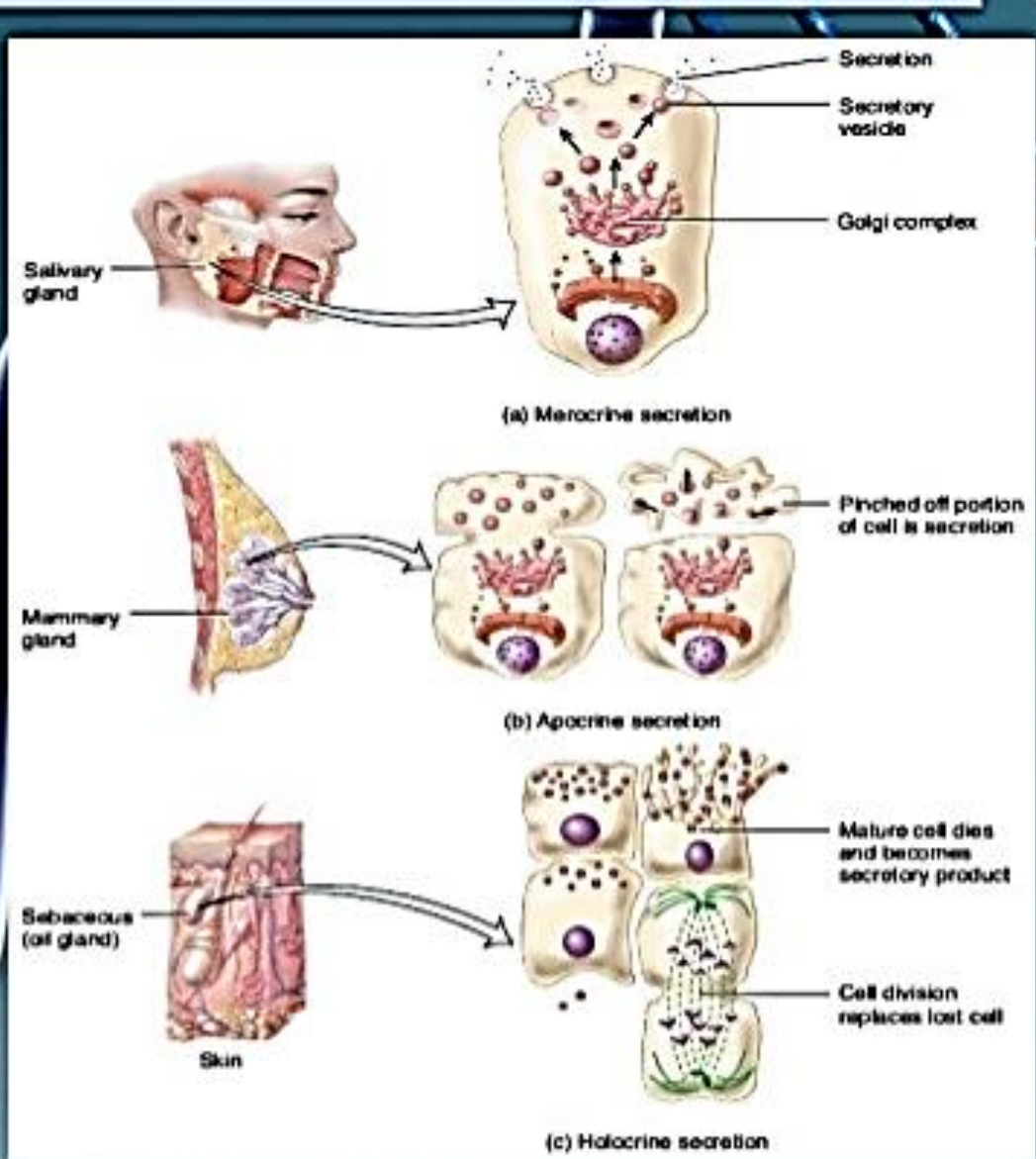
Endocrine glands produce endocrine hormones which have certain effects on our bodies.



Gland	Hormones produced	Effect of Hormone
Pineal gland	Melatonin	Affects reproductive development and daily physiologic cycles.
Pituitary gland	Growth hormone	Controls growth of bones and muscles.
	Anti-diuretic hormone	Increases reabsorption of water in kidneys.
	Gonadotrophins	Controls development of ovaries and testes.
Thyroid gland	Thyroxine	Controls rate of metabolism and rate that glucose is used up in respiration, and promote growth.
Adrenal gland	Adrenaline	Prepares the body for emergencies; increases heart rate and rate and depth of breathing, raises blood sugar level so more glucose is available for respiration, diverts blood from gut to limbs.
Pancreas	Insulin	Converts excess glucose into glycogen in liver.
	Glucagon	Converts glycogen back to glucose in liver.
Ovaries	Oestrogen	Controls ovulation and secondary sexual characteristics.
	Progesterone	Prepares the uterus lining for receiving an embryo.
Testes	Testosterone	Controls sperm production and secondary sexual characteristics.
Thymus	Thymosin	Promotes production and maturation of white blood cells.

EXOCRINE HORMONES

These are exocrine glands in which exocrine hormones are present:



GLUCAGON (PROTEIN HORMONE)

INTRODUCTION:

Glucagon is a hormone produced by α -cells of islets of Langerhans of pancreas and is an important hormone involved in:

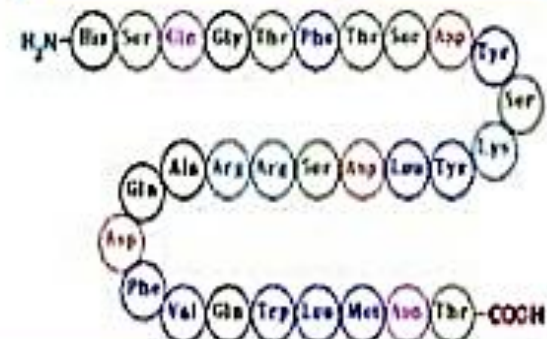
- Rapid mobilization of hepatic glycogen to give glucose by glucogenolysis
- To a lesser extent FA from adipose tissue.

Thus, it act as a hormone required to mobilise metabolic substrates from storage depots.

CHEMISTRY:

Glucagon has been purified and crystallized from pancreatic extracts and also the hormone has been synthesized. It is a polypeptide containing 29 amino acids.

Glucagon



ESTROGEN (STEROID HORMONE)

INTRODUCTION:

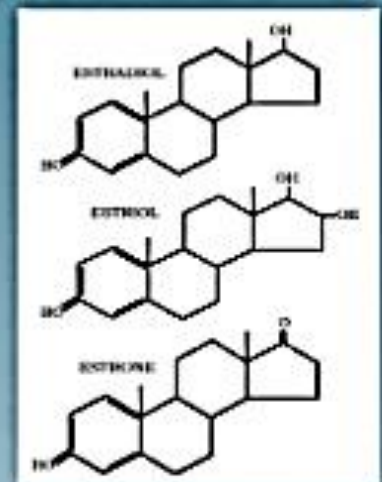
Estrogen are hormones capable of producing certain biological effects. They include:

- Growth of female genetic organs
- The appearance of female secondary sex characteristics
- Growth of the mammary duct system and numerous other phenomena which vary some what in different species.

CHEMISTRY:

The naturally occurring estrogens in humans are:

- β -Estradiol
- Estrone
- Estriol



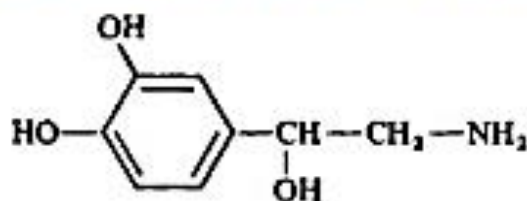
EPINEPHRINE & NOREPINEPHRINE (AMINO ACID DERIVATIVE)

INTRODUCTION:

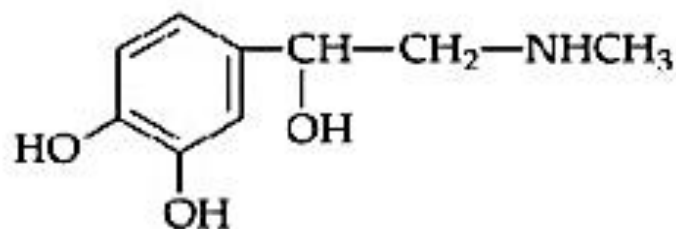
They are the hormones secreted from adrenal gland from adrenal medulla. They help in fight and flight responses.

CHEMISTRY:

- The naturally occurring forms are levorotatory.
- They don't have -COOH group.
- They act as neurotransmitters.
- They are stored in the form of granules.



NOREPINEPHRINE



EPINEPHRINE

SIMILARITIES & DISSIMILARITIES OF HORMONES & ENZYMES



SIMILARITIES:

- Both act as body catalysts.
- Both are required only in small quantities.
- Both are not used up during the reaction.

DISSIMILARITIES:

- Hormones are produced in an organ other than that in which they ultimately perform their action.
- They are secreted in blood prior to use.
- Structurally they are not only proteins. Few hormones are protein in nature, few are small peptides. Some are derived from amino acids while some are steroids in nature.

IMPORTANCE OF HORMONES

- Our bodies rely on hormones to function properly. Any problems affecting hormonal balance will affect our lives. Some things hormones are responsible for include: simulation of growth, control of cell's life span, control of immune system, metabolism regulation, control of phases of life, self preservation reactions, sexual functions, reproductive cycle.
- Hormones are chemical messengers in the body which control certain processes in the body, such as reproduction and homeostasis.

For example, insulin is a hormone in homeostasis which controls the concentration of glucose in the blood by causing its conversion into a insoluble substance. Without it (as in Type 1 diabetes), the blood sugar level would rise uncontrollably.

A 3D rendering of a DNA double helix in shades of blue, set against a teal background. The helix is positioned diagonally across the frame. The text "THANKYOU" is written in a white, serif font, and a smiley face emoji is placed to its right.

THANKYOU 😊